

parenchyma ; an endodermis and pericycle surround each stele, and in the case of the annular steles these layers occur both internally and externally. At the nodes the outer annular stele bends up into the leaf-stalk, and a branch is also given off from the margin of a gap formed in the inner annular stele ; the axial vascular strand may or may not be in continuity with the meristele of the leaf. The petiole is traversed by a single stele, similar in shape to that of certain Cyatheaceous ferns ; towards the top of the leaf-stalk the stele alters its form, and gradually gives off separate U-shaped branches to supply the pinnæ.

The most interesting feature in the structure of the pinnules is the marked papillose form of the lower epidermal cells. The roots have a triarch stele enclosed by a few layers of thick brown sclerous cells.

In structure *Matonia pectinata* presents points of agreement with several families of ferns, on the whole approximating more closely to Cyatheaceæ than to any other family ; but the peculiarities are such as to fully confirm the conclusion previously drawn from external characters that *Matonia* should be placed in a separate division of the Filices.

After comparing the structure of the Malayan species with that of other fern genera, the paper concludes with an attempt to give an account of the geological history of the Matonineæ. The genera *Laccopteris* and *Matonidium* are dealt with at some length, and reference is made to other Mesozoic ferns, which may probably be included in the same group.

The data furnished by an examination of palæontological evidence lead to the conclusion that in *Matonia* we have a survival of a family of ferns, now confined to a few localities in Borneo and the Malay peninsula, and represented by two living species, which in the Mesozoic epoch had a wide geographical range, being especially abundant in the European area.

“Note on a new Form of light Plane Mirrors.” By A. MALLOCK.

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Having recently, in the course of some experiments on air waves, had occasion to make use of some very thin films as coverings for the openings of resonators, it occurred to me that such films, if stretched over rings with edges ground to a true plane, might be used as plane mirrors, and the following note records the results of the trials made with this object in view.

The best films were obtained by letting a few drops of a solution of pyroxyline in amyl acetate spread on the surface of water and lifting

the film, left after the evaporation of the solvent, on a ring previously placed beneath the surface.

Good films can also be obtained in this way from copal varnish, but they are more difficult to handle, and the intrinsic strength of the material is not nearly as great as that of pyroxyline.

In order to lift the films off the surface of the water without folds, and without getting any of the parts doubled, it is desirable that the ring used for the purpose should be not less than half an inch deep, *i.e.*, a length of half an inch cut off a tube of the required diameter, or a strip half an inch wide bent into a circle and the ends joined. If the depth is less than this the overlapping part of the film is liable to be carried round the lower edge by the capillary action of the water, and to spread itself irregularly on the under surface of the stretched part while being lifted.

The ring should be rested on a wire tripod with long turned-in feet so that the pyroxyline solution may spread well beyond its edges before encountering the tripod legs; and, in order that the film while being lifted may not be broken by the drag of the water enclosed by it and the ring, air should be introduced inside the latter through a pipette during the process. A little practice makes it quite easy to secure uniform films with certainty in this way.

After removal from the water the film should be allowed to drain for some minutes until the surface is free from drops, and it may then be stretched over the worked ring whose edge is to form the boundary of the mirror. In order to do this the worked ring is placed on a circular support some inches in height and a little larger in diameter than the ring itself. The film, which at this stage of drying is tough and extensible, is then laid in position over it, and the lifting ring forced downwards until the film tears away. It will be then found that the film is left well stretched over the worked ring and adherent to its edge and side.

The lifting rings should be about half an inch larger in diameter than the worked rings.

If the film is not much more than a twenty-thousandth of an inch in thickness its surface is glassy and reflects light well, but if much thicker than this it tends to show a crape-like or finely grained structure, and its quality as a reflector is not so good.

I found at first great difficulty in silvering the films: in fact as the film comes from the water, it refuses altogether to receive the silver deposit, but if well washed under a very gentle stream of distilled water as soon as it is stretched on the mirror ring, and then thoroughly dried, a fair coating of silver may be obtained.

It seems essential that the amyl acetate should be completely evaporated, and this being accomplished, the other requisite is absolute surface cleanliness both of the film and the silvering bath.

To ensure this requires considerable care. The film after being washed should be dried as quickly as may be in a warm drying chamber, and it is advisable not even to touch the ring with the hand until its sides are quite dry. The dish also in which the silvering solution is placed must be carefully washed just before use, first with nitric acid, then with water, and finally with distilled water; but on no account should it be wiped or touched with the hand.

Before taking these precautions, I never succeeded in getting even a tolerable silver surface, though I tried many other devices which need not now be described. Even the best results I have hitherto obtained are not quite satisfactory, so very ready are the films to lay hold of any kind of scum with which they may be brought in contact.

The best material for the mirror rings I found to be glass, which is much more easily ground to a true surface than most of the metals I tried, and suitable rings of very thin glass may be easily obtained by cutting up beakers or test-tubes with a glazier's diamond in a lathe.

The edges may then be quickly ground to a plane on a flat lap with coarse emery or carborundum (which I prefer), and finished with fine emery, though as the edges need not be polished it is not necessary to use nearly such fine emery as is required for ordinary optical surfaces.

The most important point in getting the edge of the ring to a true plane, is to use a very light pressure in grinding, and the thinner and weaker the ring the lighter the pressure required.

When the grinding is well done, the definition given by reflection from the stretched film is quite equal to that of a worked glass surface of the same area, at any rate up to 2 inches or $2\frac{1}{2}$ inches diameter, and up to this diameter also it makes no perceptible difference to a reflected pencil of rays whether the plane of the mirror is vertical or horizontal, showing that the weight of the film has no appreciable effect in determining its form.

The weight of these mirrors is practically the weight of their supporting rings, and with reasonable care a 2-inch ring may be made weighing considerably less than 10 grains, and although it will probably be impossible to rival with them the brilliancy of silvered glass, there are I should think many cases where good definition, and extreme lightness are requisite (as for instance in the suspended mirrors of photographic recording instruments) in which such mirrors as these might be useful.